



# RTTOV development status

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Met Office

# What is RTTOV?

Estimate of atmospheric state  
and surface parameters for  
observation point  $X$

Viewing and sun  
angles



**RT model  
for required sensor**

Time ~1ms  
for 20 chans



Radiances for required satellite channels  $y=H(X)$  and  
optionally Jacobians as TL, AD, or K

$$H' \equiv \frac{\partial y_i}{\partial X_j}$$



# RTTOV v11.1 – released May 2013

- VIS/NIR clear-sky (and simple cloudy) simulations
- Land surface reflectance (BRDF) atlas

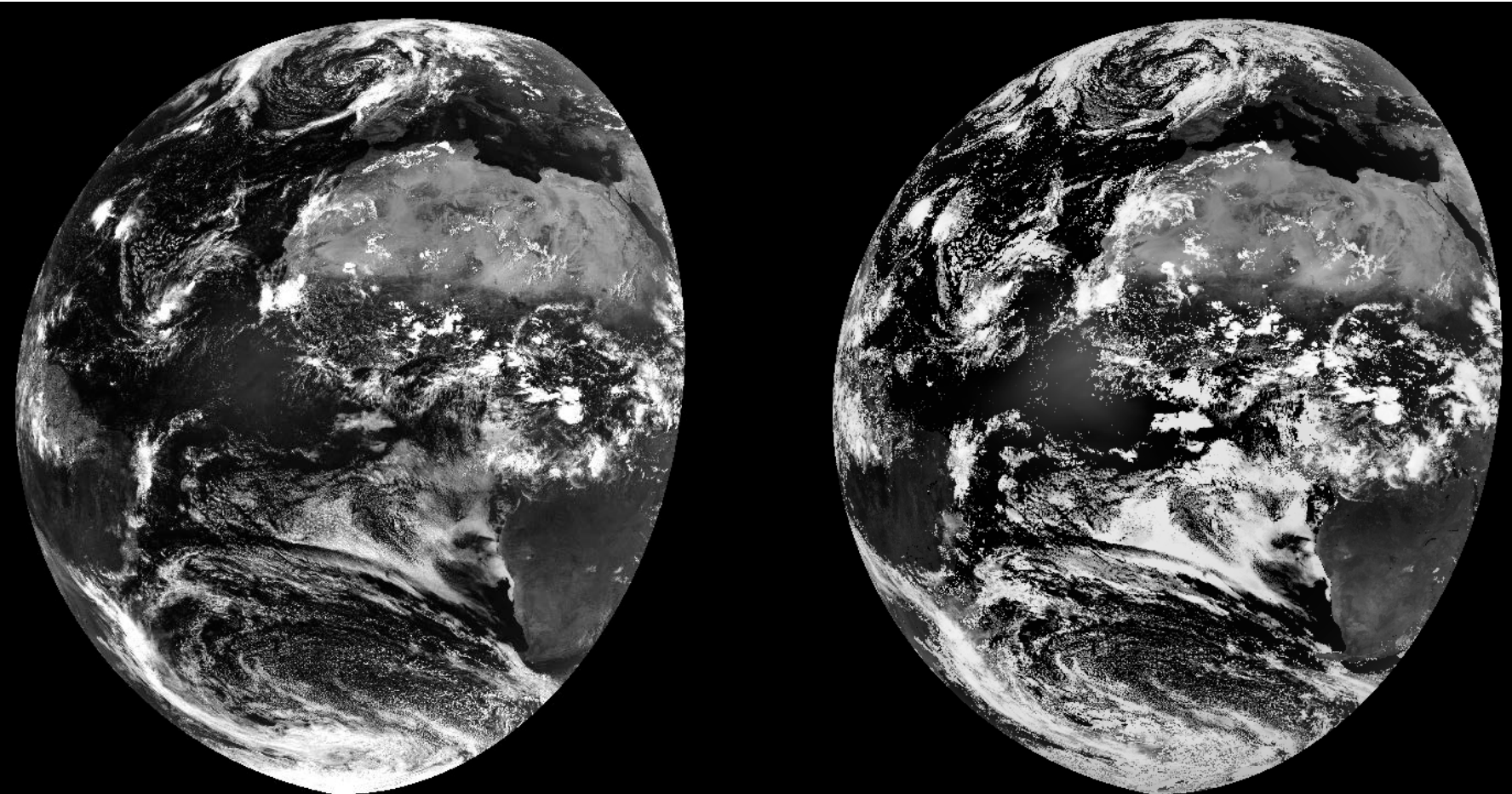


# VIS/NIR clear-sky/simple cloud

*Simple cloud => input single CTP and cloud fraction*

*Output is linear combination of clear-sky and cloud-top radiances, making some basic assumption about cloud top reflectivity.*

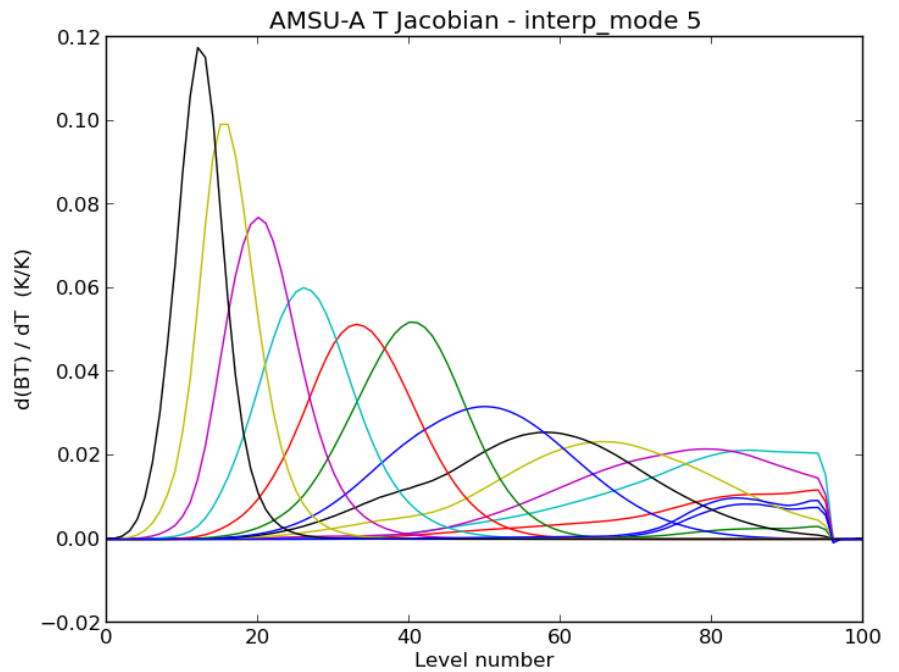
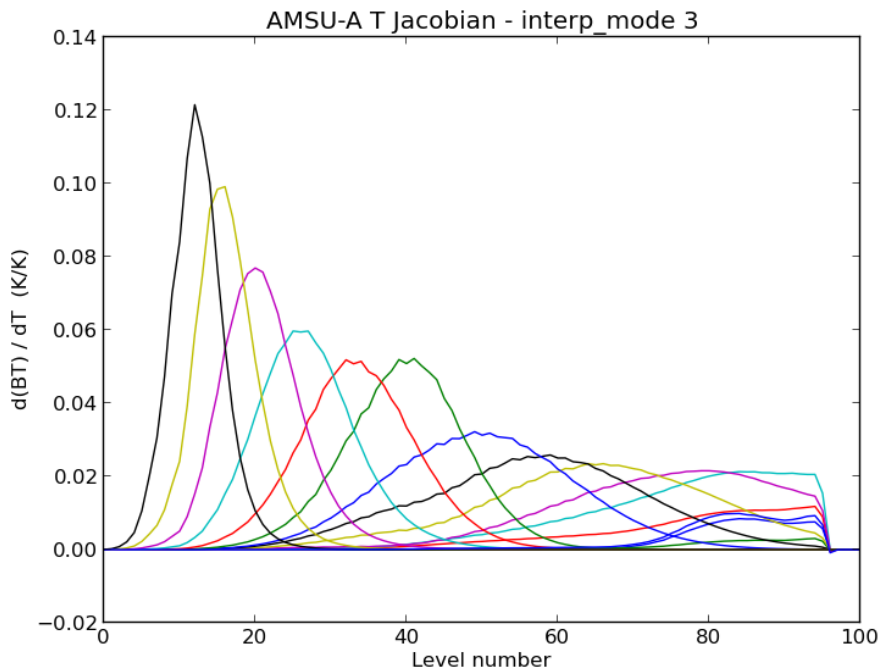
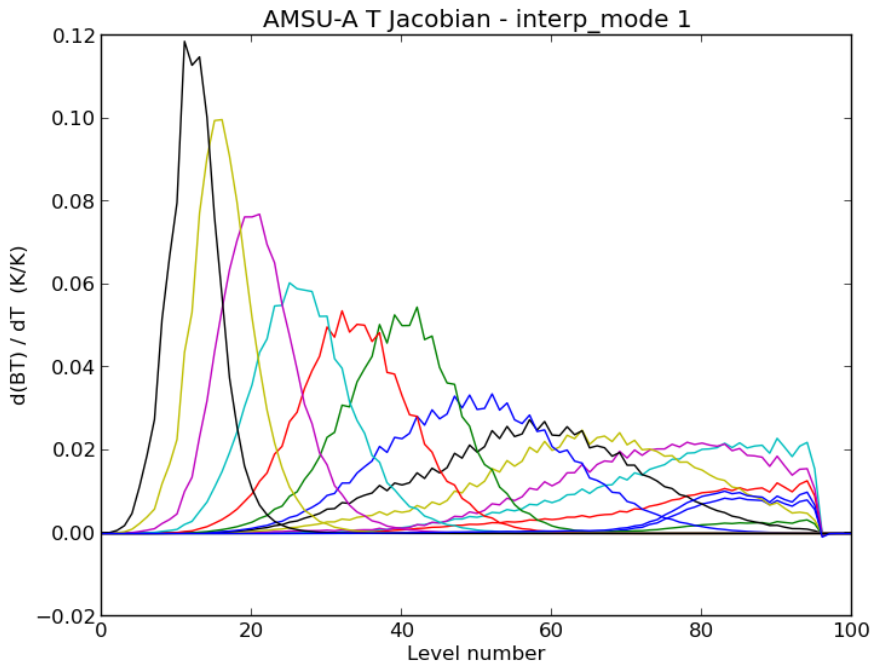
SEVIRI 0.6 $\mu$ m observations (left) and simulations (right)





# RTTOV v11.1 – released May 2013

- VIS/NIR clear-sky (and simple cloudy) simulations
- Land surface reflectance (BRDF) atlas
- NLTE bias correction (AIRS/CrIS/IASI)
- PC-RTTOV extended to cloudy profiles over sea
- IR scattering simulations:
  - Two new aerosol particle types (volcanic ash, Asian dust)
  - New parameterisation for ice clouds
  - Option to input scattering parameters explicitly
- New interpolation option





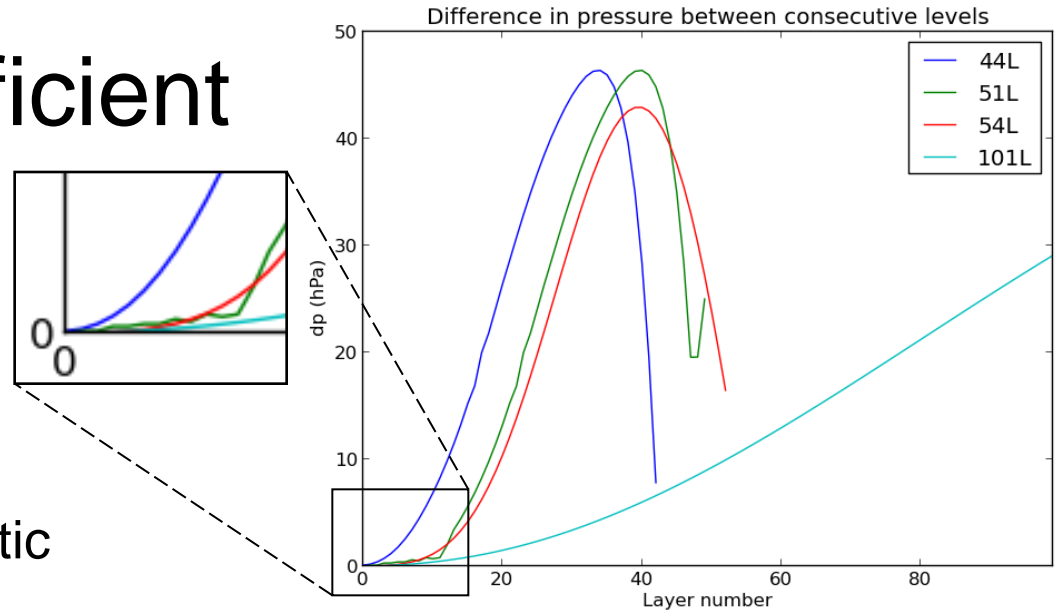
# RTTOV v11.1 – released May 2013

- Option to treat surface as Lambertian for MW sensors
- SSU coefficients accounting for time-variation of CO2 cell pressure in the instrument
- Coefficients in HDF5 format
- Optimisation of K model for v7 predictor coefs
- Optimisation of IR emissivity atlas in speed and memory usage

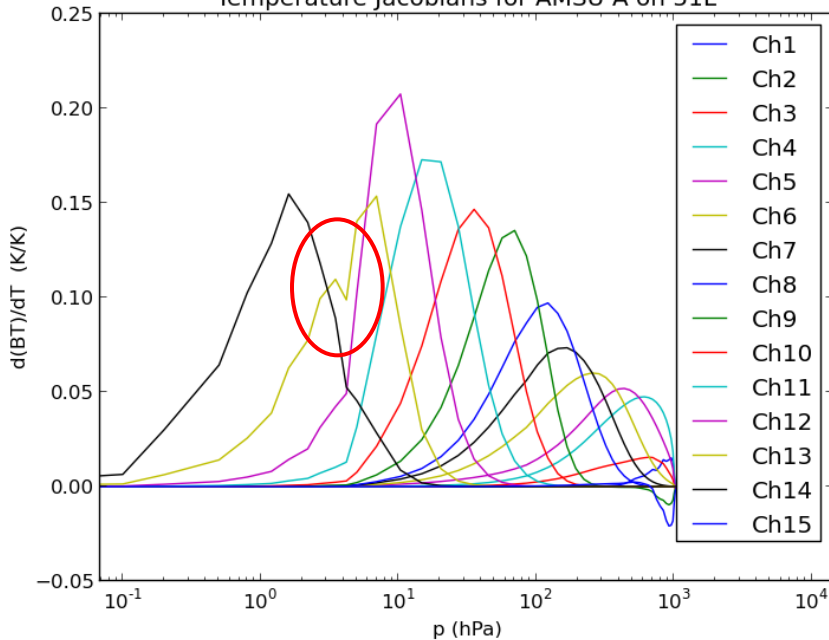


# New coefficient levels

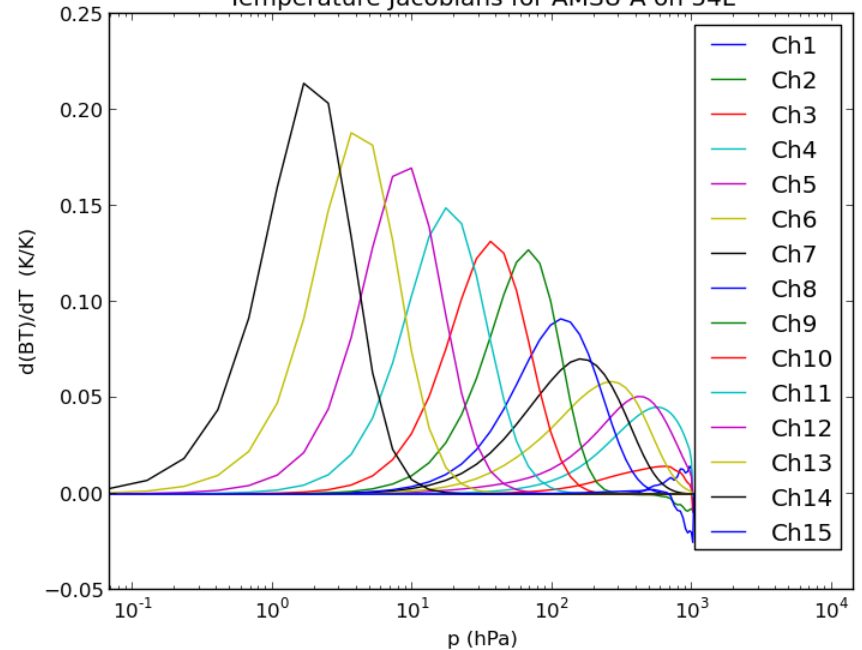
- 51L had extra levels added by hand: leads to features in Jacobians.
- New 54L derived from analytic formula: better resolution everywhere except ~1-10hPa.



Temperature Jacobians for AMSU-A on 51L



Temperature Jacobians for AMSU-A on 54L







# Latest coefficients – MW

- Liebe-MPM 89/92, no-Zeeman code with O2, N2, WV and optionally climatological O3
- ECMWF 83 profile set
- RTTOV-7 predictors on 54 levels
- Zeeman coefficients for SSMI/S and AMSU-A also available; there is on-going work on Zeeman coefs

## New files:

- AMSU-A with shifted frequencies for channels 6-8
- GPM GMI
- Nimbus-7 SMMR



# Latest coefficients – VIS/IR

- LBLRTM v12.2, AER v3.2, MT\_CKD\_2.5.2; ECMWF 83 profile set
- Coefficients on 54 levels; also 101L for hi-res IR sounders

## New files:

- Solar-compatible files for many GEO and LEO sensors including: ABI, AHI, AVHRR, MODIS, MTSAT imager, SEVIRI, VIIRS.
- Updated v9 predictor hi-res IR sounder files (O3, CO2, CO, CH4, N2O)
- MTG-FCI, IASI-NG
- Nimbus-4 IRIS, SSU PMC-shift files (PMR coefs are in pipeline)
- MODIS and HIRS with shifted channels

HDF5 is becoming the preferred format for disseminating hi-res IR sounder coefficients.



# RTTOV v11.2 – due May 2014

- Further improvement to interpolation
- FASTEM-5: improvements to treatment of azimuth angle
- Optimisation (speed) of K model for v8 and v9 predictor coefs
- Optimisation (speed and memory usage) for IR scattering simulations, especially with cloud (~20-30% faster and ~50% memory usage in direct/TL/AD/K)
- Optimisation (speed) for PC-RTTOV simulations
- Coefficient I/O more flexible
- Test suite profiles updated: now based on US76 standard atmospheres.
- Bug fixes.



# RTTOV v12 – due end 2016

- Accurate VIS/NIR multiple-scattering model
- SO<sub>2</sub> as optional trace gas
- Improved ice cloud parameterisation for IR scattering
- Updated IR sea surface emissivity model
- Improvements to IR emissivity atlas (view-angle correction)
- IR emissivity and BRDF atlases moved to HDF5 format
- Optimisation
- Retire old interpolation options
- Retire old IR ice cloud parameterisations based on effective diameter



# RTTOV website

NWP SAF website is being moved to new servers:

<http://nwpsaf.eu/>

Bug fixes are posted on the RTTOV v11 web page:

[http://nwpsaf.eu/deliverables/rtm/rtm\\_rttov11.html](http://nwpsaf.eu/deliverables/rtm/rtm_rttov11.html)

Web page dedicated to RTTOV v11 coefficients most of which are compatible with RTTOV v10:

[http://nwpsaf.eu/deliverables/rtm/rttov11\\_coefficients.html](http://nwpsaf.eu/deliverables/rtm/rttov11_coefficients.html)

Feedback always welcome – including suggestions for new/modified content on the new site.



## NWP SAF forums

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It is currently Fri Mar 21, 2014 10:54 am

Last visit was: Wed Mar 19, 2014 4:53 pm

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RTTOV	TOPICS	POSTS	LAST POST
<b>RTTOV 11</b> Version 11 of RTTOV was released in June 2013. This is the most recent version of RTTOV.	10	14	by <a href="#">james.hocking</a> Fri Oct 18, 2013 8:54 am
<b>RTTOV 10</b> Version 10 of RTTOV was first released in January 2011, but users are advised that this version of RTTOV has now been superseded by RTTOV v11, which should be used in preference to RTTOV v10.	42	95	by <a href="#">roger.saunders</a> Mon Dec 23, 2013 12:45 pm
<b>Older versions</b> Older versions of RTTOV should be discussed here.	14	22	by <a href="#">mallha</a> Thu Jan 09, 2014 12:50 pm
AAPP	TOPICS	POSTS	LAST POST
<b>AAPP Announcements</b>	28	41	by <a href="#">nigel.atkinson</a> Mon Feb 24, 2014 9:30 am
<b>AAPP General Discussion</b>	15	31	by <a href="#">stephan.finkensieper</a> Mon Feb 24, 2014 3:26 pm

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 Most users ever online was **22** on Sat Mar 16, 2013 4:44 am

Registered users: [james.hocking](#)  
 Legend: [Administrators](#), [Global moderators](#)

### STATISTICS

Total posts **206** • Total topics **115** • Total members **137** • Our newest member [krismianto](#)

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Thanks for your attention

Questions?



# New coefficient levels

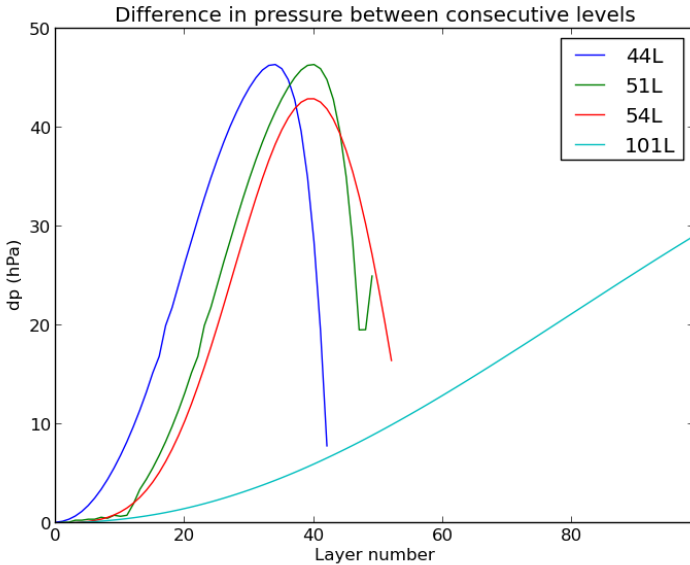


Table shows RMS differences of simulated AMSU-A BTs using 101L coefficients vs 51L/54L coefficients for 52 diverse profile set

Channel	51L coefs	54L coefs
1	0.102	0.064
2	0.063	0.042
3	0.091	0.065
4	0.047	0.031
5	0.026	0.019
6	0.035	0.029
7	0.032	0.030
8	0.026	0.024
9	0.058	0.047
10	0.093	0.056
11	0.138	0.100
12	0.147	0.147
13	0.069	0.220
14	0.125	0.237
15	0.131	0.086





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# Latest coefficients – VIS/IR

- LBLRTM v12.2, AER v3.2, MT\_CKD\_2.5.2
- ECMWF 83 profile set
- RTTOV-7 predictors (O3) on 54 levels  
and on 101 levels for AIRS/IASI/CrIS/IASI-NG (IR only)
- RTTOV-8 predictors (O3, CO2) for SSU, HIRS, hi-res  
sounders (IR only)
- RTTOV-9 predictors (O3) on 54 levels for VIS/IR  
instruments (solar-compatible)
- RTTOV-9 predictors (O3, CO2, CO, CH4, N2O) on 101  
levels for AIRS/IASI/IASI-NG, *CrIS coefs forthcoming*,  
(solar-compatible)